

An isotopic evaluation of groundwater component in sewage in a highly urbanized catchment, the metropolitan area, Japan

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An isotopic approach to directly quantify groundwater infiltration into the sewer systems is presented. The study was carried out in the highly urbanized catchment with a population of over one million and of some 73 km² in area, the metropolitan area, Japan. The study area is mainly composed of the plateau of the Pleistocene period.

The delta-D values of sewage samples after a no rainfall period of one week were measured at one hour interval from 10:00 Sept. 19 to 09:00 Sept. 21, 2007 at the sewage plant treating all the sewage produced from the catchment area. A difference in delta-D that can reach some 10 permil is observed between the *real* foul sewage (-64.3 permil delta-D) of city water (tap water) origin and groundwater (-54.5 permil delta-D) originating from local precipitation. This significant difference in isotopic composition can be used to evaluate the groundwater component in sewage with accuracy. The application indicates that the groundwater component presents strong fluctuations at an hourly scale, that is from 21 to 41% of hourly sewage flow. At a daily scale, on the other hand, groundwater proved to account for as much as 34% of daily sewage flow for both 24 hours of 19 to 20 Sept. and 20 to 21 Sept. The results are thought to have important implications for a better understanding of the shallow groundwater balance in highly urbanized areas.